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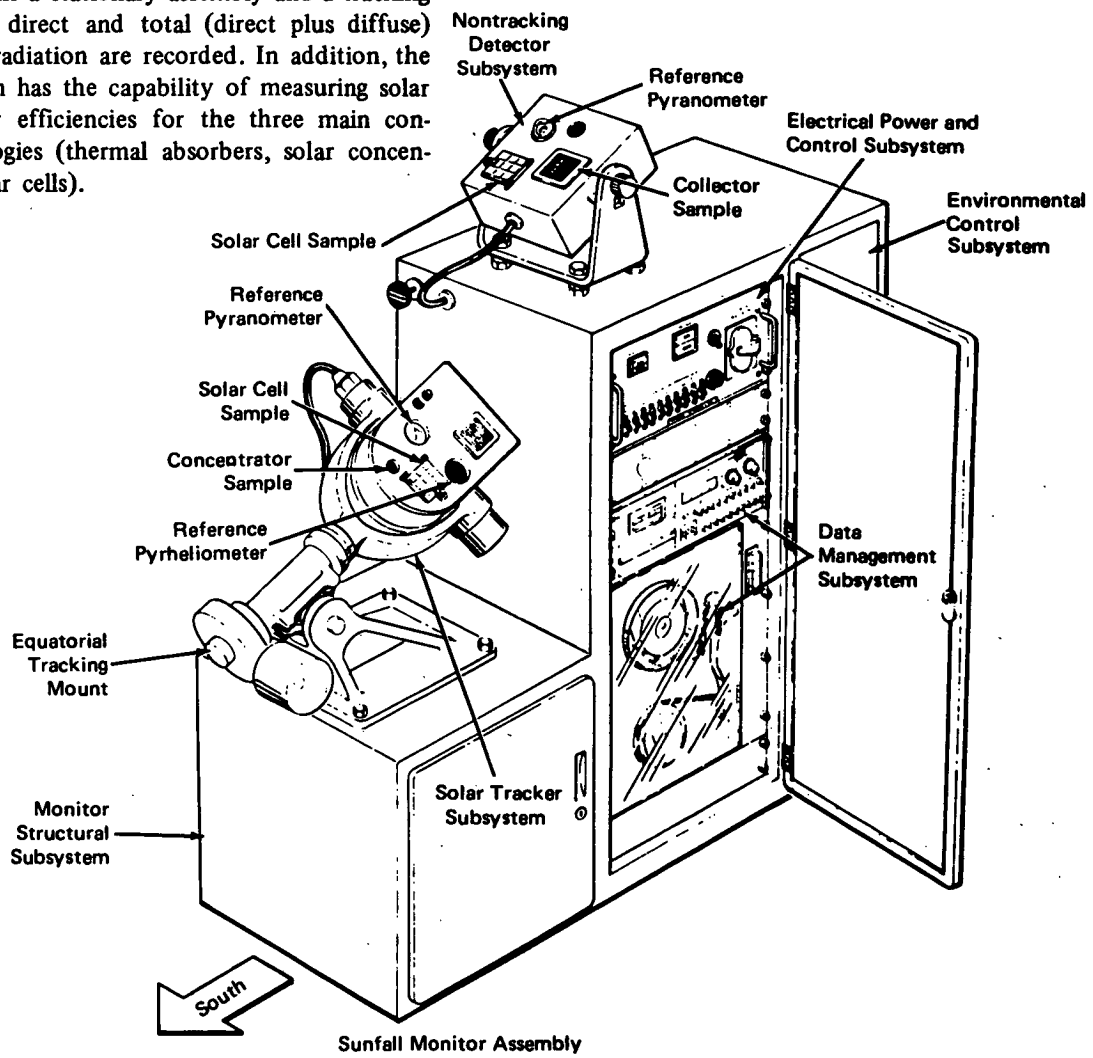
NASA TECH BRIEF

Marshall Space Flight Center

Remote Sunfall Monitor: A Concept

In the study of solar energy systems, it is important to determine the amount of solar energy available at proposed converter sites. The Sunfall monitor is proposed as a spectral monitor system designed to record digital data simultaneously from two types of sensors, mounted on both a stationary assembly and a tracking assembly. Both direct and total (direct plus diffuse) values of solar radiation are recorded. In addition, the proposed system has the capability of measuring solar energy collector efficiencies for the three main conversion technologies (thermal absorbers, solar concentrators, and solar cells).

The proposed Sunfall monitor (see figure) is a system consisting of six subsystems: (1) the solar radiation detection/sample comparison subsystem, (2) the data management subsystem, (3) the environmental



Sunfall Monitor Assembly

(continued overleaf)

control subsystem, (4) the electrical power and control subsystem, (5) the solar tracker subsystem, and (6) the cleaning subsystem (not shown). Capability is provided within the Sunfall monitor system for measuring the effectiveness of both solar-concentrator (reflector) material surfaces and thermal-collector (absorber) materials.

The solar radiation detection/sample comparison subsystem will consist of normal-incidence radiation detectors (pyrheliometers) and global (total Sun and sky) radiation detectors (pyranometers). Two pyrheliometers and one pyranometer will be mounted on a Sun tracking instrument stand so as to duplicate the solar radiation conditions seen by tracking-type solar energy converters of both the simple collector type and the concentrator type. The normal-incidence detectors will be so oriented that, during all daylight hours, the plane of the radiation sensing elements is normal to the Earth-Sun vector (except for the concentrator pyrheliometer, which is offset 90° in order to measure radiation reflected from the concentrator sample). A second pyranometer and related test samples will be mounted on a fixed platform with tilt angle adjustability from horizontal to south-facing vertical positions. In the horizontal position, each detector views the 2π-steradian hemisphere existing at the instrument location without shading or obstruction by adjacent detectors or other system components Two of the normal-incidence detectors, one pyrheliometer, and one pyranometer will serve as reference instruments against which the solar energy absorption capabilities of the tracking test sample will be compared.

In addition to providing data for material evaluation, the Sunfall monitor can be made to provide spectral data on the ultraviolet, visible, and infrared regions of the spectrum. The modifications required to convert the Sunfall monitor from the material evaluation model to the spectral model will consist primarily of the replacement of existing sensors and sample evaluation modules by appropriately filtered pyrheliometers and pyranometers.

The solar tracker subsystem will be available in either automatic or semiautomatic configuration. The fully automatic configuration will consist of an equatorial mount with associated sensing and control equipment to ensure continuous, unattended Sun tracking capability. Subsystem tracking error will not exceed ±3 arc-minutes on each axis. The semiautomatic configuration will consist of a basic mount with a minimum of associated control equipment for use in a low-cost system at a location where daily adjustment can be accomplished.

The structural subsystem will provide a mounting surface for Sunfall sensors, trackers, environmental conditioning, and electrical subsystems. The structure will provide cover, doors, and louvered panels, as required, to give passive environmental protection from extreme weather conditions. It will be a truck-transportable unit built to withstand dust, rain, and moisture. In order to help control internal temperature, the outside surface will be painted white, and adequate insulation will be provided on the inside surface. The monitor system incorporates an environmental control subsystem to maintain the electronic equipment at acceptable environmental levels. The subsystem is designed to maintain adequate conditioning under environmental extremes over the full geographic range of the Sunfall monitor.

A data management subsystem records all the data from the monitor sensors in a computer-ready format, along with timing information to enable rapid computerized data reduction.

Note:

Requests for further information may be directed to:

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Patent status:

This invention is owned by NASA and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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